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ABSTRACT

The purpose of this paper is to discuss the alleged special difficulties in teaching very young children how to interpret cartographic symbols. Adults too often reduce or temporarily destroy interest by introducing too many complications too fast. There is a vast difference between acceptance of a fact and understanding of the cause of the fact. In teaching children how to understand maps, teachers often seek to deal with the difficult aspects first, such as the representation of a curved surface on a plane surface, and they seek to press from simple facts to complicated explanations at too fast a pace. Understanding symbols involves simply the ability to associate ideas, a process commenced shortly after birth. Many teachers assume that it is essential to provide pictorial maps if young children are to understand cartographic symbolism. But to use facsimile representations first only prolongs the process. As to the problems connected with the round world and flat maps, the important thing is to convince the child that it works, and how. It is suggested that nine years be accepted as the minimum age at which instruction in contouring be usefully commenced. The most important thing in teaching cartographic symbolism is that children must be brought to understand at each stage of instruction why something is being done in a certain way, and the object of doing it.
(Author/JLB)

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CARTOGRAPHIC SYMBOLISM AND VERY YOUNG CHILDREN

by

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The purpose of this paper is to discuss the alleged special difficulties connected with teaching very young children how to interpret the symbols used in cartography. By "symbols used in cartography," something more is meant than those symbols which are most often referred to as "Conventional Signs." These, of course, are included but, additionally, it is necessary to consider the concept of the map as representing part of the surface of the Earth and of the various methods of representing the relief of the land and the depths of the sea. For the purpose of this paper, therefore, layer contouring must be regarded as one of a number of symbolical devices used by the cartographer to represent what he wants to show without attempting any form of facsimile representation.

The problem of how to teach very young children how to read a map is, like most problems connected with teaching anything, largely a psychological one, and psychological principles and truths (with which most teachers are, or ought to be, familiar) are involved from the outset. Whilst, however, few people would quarrel with this statement, it is a curious fact that many of those who complain most about the alleged special difficulties of teaching children how to understand maps are making those difficulties greater, firstly by overestimating them and, secondly, by ignoring the psychological principles involved and failing to base their methods of teaching upon them. For these reasons the author begs leave to devote a little space to the purely psychological aspects of teaching, with special

reference to the understanding of symbols and, rightly or wrongly, he has decided to try to do this with the minimum use of technical terms. The choice was a difficult one because, if scientific jargon is much used, the nonspecialist must read with a glossary at hand, whilst, if jargon is avoided, it is almost impossible to avoid the use of imprecise words or phrases to which the meticulously minded may justifiably object. The writer has preferred to avoid the use of technical terminology as far as possible and if, therefore, children are referred to as "ordinary" children or as "exceptional" children it is hoped that readers will not fret overmuch about the precise meaning of the words "ordinary" or "exceptional," but will be content to apply to those words the meanings customarily given to them in everyday conversations about this and that. Similarly the phrase "very young children" is meant to apply to children at any age between six years and c'even and the "generality" of children means the great mass of "ordinary" children of about the same age--that is to say children who seem, for their age, to be physically and mentally developed to a normal degree and who exhibit no physical disabilities nor any peculiarities of temperament such as would mark them down for particular notice. In the strictest scientific sense these definitions would be regarded as far too loose, but the writer believes them to be adequate for his purpose. That difficulties will be encountered there is no doubt, but even the strictest of scientists fails to avoid difficulties with terminology.

If there is one mistake which people are liable to make more often than another when dealing with very young children it is the mistake of taking it for granted that something or other will be altogether too difficult for them to understand. In point of fact it is probably true to say that the majority of "ordinary" very young children are capable of

understanding a good deal more, a good deal better than most of their elders are ready to believe. Whether such children exercise their capabilities to the full or not depends upon a variety of considerations some of which may be examined later but one of the writer's contentions is that, when children do not seem able to understand something which, by ordinary standards, they ought to be able to understand, the cause of their failure is too often diagnosed as lack of ability whereas it is far more often lack of interest. The word "understand" is here used in a wide sense, covering not only single ideas but also the appropriate association of two or more simple ideas and, on occasion, the comprehension of an elementary principle and its application. As an example of the latter consider the relationship which exists between the large and small gear wheels of a bicycle and the chain which connects the two. An "ordinary" child of, say, six years will not take very long to grasp the fact that such a relationship exists and that movement of one part results in movement of another.

It is interest which provides the child with the impulse to learn and, happily, most children possess abundant stores of interest. Unfortunately, however, adults who seek to stimulate and direct natural interest too often succeed only in reducing or even temporarily in destroying it by introducing too many complications too rapidly. This explains the phenomenon of the child who, having grasped an initial idea exceptionally quickly, fails dismally to understand a secondary idea connected with the first even though the latter may be actually the more simple of the two. The trouble in such a case is almost always due to the fact that the child was allowed insufficient time fully to develop (and partially to exhaust) its interest in the initial idea before the second idea was introduced. As a result interest was prematurely divided between the two ideas, the

small mind was confused and irritated and attention wandered to some other single idea to which undivided attention might be given. Children vary not only in the amount of time they require to devote to a particular thing or idea but also in the amount of time they <u>like</u> to devote to it. Of two children of apparently similar intellectual ability and at apparently the same stage of development, one may be happily absorbed for ten or fifteen minutes with a single idea whilst the other has exhausted interest in the same idea in five minutes. Since most adults get bored more quickly than do most children it is particularly important for the adult to avoid applying his or her own "interest-period" which will usually be shorter than that of the child. The ideal method is to allow each child to determine its own "interest-period," and it is the impossibility of doing this when teaching large classes which provides one of the strongest and most valid arguments against the prevailing average of fifty to a class in our primary schools.

There is, of course, a vast difference between the child's acceptance of a fact and its understanding of the <u>cause</u> of the fact or of that fact's relationship to other facts. Thus it is relatively easy to teach a child the fact that the black object standing on the hall chest is called the telephone but a very different thing to convey to the child how the telephone works. In the case of a very young child one would have to be content for quite a long time with having succeeded in inducing the child to recognize the object by its name, next would come the association of the object with talking and later with talking to someone unseen and far away as distinct from someone present and visible. All that might be achieved within months but the child's understanding of the scientific principle upon which the telephone works would, almost certainly, have to be deferred

for several years. The importance of mentioning such an instance lies in the fact that, whilst most teachers would make no mistakes either in method of time-allowances in regard to teaching a child something about the telephone, many would and do make mistakes in both respects in regard to teaching children progressively how to understand maps. Too often they seek to deal with the really difficult aspects first--such as the representation of a curved surface on a plane surface--and also they seek too often to press on from simple "facts" to complicated explanations of such "facts" at far too swift a pace. In fact it is the failure by many teachers to apply basic principles of the theory of teaching when maps are concerned which accounts in no small measure for the fact that so many of them experience exceptional difficulties when trying to accustom children to the use and interpretation of cartographic symbols. Were that not the case the writer would not have felt it necessary to remind his readers of some of these psychological truths at the outset.

An astonishing amount of near nonsense has been talked and written about the alleged inability of very young children to understand symbols used on maps. This is the more surprising when one remembers that the process of understanding the meaning of symbols involves no more than the ability to associate ideas, which is a process commenced by every mentally-healthy human creature very shortly after birth. In its simplest and earliest manifested forms this process approximates closely to what the physiologists call the "conditioned response" and, when the process is nearest to that semi-automatic reflex action, it may, perhaps, be said not to involve actual <u>thinking</u> as we adults understand thinking <u>but it is one of the processes of learning</u>. When the baby sees its special feeding-plate a complicated series of mental and physical reactions takes place.

Whether these amount to no more than what takes place in the dog when it sees its dinner-plate depends mainly upon the age of the baby, but in both cases what takes place is the beginning of the association of ideas and, in that way, the beginning of the comprehension of the meaning of symbols. The point which the writer desires to make is that a process which commences so early in life and which is so fundamentally a part of natural growth and development cannot, in the nature of things, be a process which only exceptionally equipped children may be expected to be able to carry out. On the contrary it is a process so naturally a part of growth and set in operation by nature at such an early stage in the life of every ordinary child that it should be (and is) one of the easiest forms of learning. We all know from observation that this ability to associate ideas--to recognise the connection between something seen or heard with something else--develops rapidly. Quite when or in what manner the "conditioned response" develops into what may justifiably be called reasoning, the writer does not pretend to know, nor is it particularly pertinent to the matter under consideration. What is pertinent is that it would seem to be an established fact that there is absolutely no justification for the widely held belief that to ask very young children to understand simple cartographic symbols is to put a severe strain upon their little minds. In fact it puts little or no more strain upon them than to ask them to accept a block of wood as representing a motor-bus or three blocks of wood tied together as representing a train. In fact, if left to themselves, they will often do some such thing without the suggestion being made. What does put too severe a strain on the minds of very young children is the attempt to make them understand at too early an age what is difficult enough even for the intelligent adult. To try to teach a child in ever the

most simple and generalized way <u>how</u> a portion of the curved surface of the earth can be represented reasonably accurately on a flat piece of paper is to try to do the same thing as to try to make that child understand <u>how</u> the telephone works (that is to say the theory of the telephone instrument) instead of being content with teaching its name and what one can do with it. Yet many teachers do try to give very young children <u>some</u> idea of the theory of projections and, when challenged on the wisdom of this, will say in explanation that they feel obliged to do so because of the existence in the classroom of a globe. "How" they say "can we reconcile the globe with the maps?" Or again, "How can we expect a child to believe us that the flat map of Africa hanging on the classroom wall is, for all ordinary purposes, as good and accurate a map as the map of Africa which they can see on the curved surface of the globe? Surely we have to try to prove it to them somehow even if only in the simplest terms." The answer, of course, is that it is <u>not</u> necessary to try to prove such a contention at such an early stage in the child's education any more than it is necessary to prove <u>how</u> the telephone works. What matters is that the telephone <u>does</u> work <u>and that that fact can be satisfactorily demonstrated to the child</u>. The same can be done in the case of the flat map and the globe.

By and large, children are very co-operative and obliging when they are being taught so long, of course, as their interest is maintained. In order to make progress with the matter in hand (be it game or lesson) they will readily accept many unexplained things as facts or, at least, be satisfied with some very simple form of explanation or proof--preferably, of course, by demonstration. If, for instance, one gives a small child a lump of wood and says "Let's call this a motor-bus," the child will agree without hesitation. It knows that the lump of wood is not a motor-bus but,

for the purpose in hand, is ready to accept the lump of wood as a symbol. At a later stage mounting interest and enthusiasm plus the near magic of imagination will transform that piece of wood so that, to all intents and purposes, it <u>is</u> a motor-bus so far as that child is concerned. The block of wood can be pulled or pushed along the garden path and, although there is no doubt that it <u>is</u> a block of wood and that the garden path <u>is</u> the garden path, yet the child sees it in the mind's eye as a motor-bus travelling on the road. Likewise one may say to a child "let's call this piece of paper the garden." Initially this may be a more difficult idea to put over but, by calling into play the same forces of interest and imagination, it will usually be possible to induce the child to accept the piece of paper as representing the garden, particularly if an initial demonstration is followed by an invitation to the child actively to co-operate in the development of the idea. For instance:- one draws a double line down the side of the paper to represent the garden path and a few other lines to indicate the boundaries of the lawn and the flower-beds. The child watches and, with any luck, one is soon encouraged to proceed a little further either by the rapt attention of the child or as a result of some pertinent question. "Now you mark where the apple trees are," one invites and the child complies--perhaps not with any very great degree of accuracy but no matter--the battle is won. Soon the piece of paper with the marks upon it has become to the child a very real representation of the garden. Difficulty arises with the chicken house. The child attempts a drawing but this provides too much difficulty; the child shows signs of becoming disheartened and loss of interest is imminent. "Let's just draw a square and call that the chicken house," one suggests. Enthusiastically the child accepts the idea and, unknowingly, of course, accepts at the same time the basic principle of

cartographic symbolism. Soon the piece of paper is covered with symbols. The child has made its first map. That will be enough not only for the day but, perhaps, for several weeks. Then another opportunity will arise and the experiment can be carried a stage further.

Before an attempt is made to consider further stages in the child's education in the use and making of maps it may be as well to say a word or two about the prevalent idea that facsimile representations (drawings) of the features of a landscape and of the objects to be seen thereon ought to precede the use of symbols. Many teachers and some child psychologists and training college lecturers seem content to let it be assumed that the provision of such 'pictorial' maps is essential if very young children are to be brought to an understanding of cartographic symbolism without undue difficulty. The writer disagrees emphatically with that idea although ready enough to agree that such pictorial maps have their uses, particularly in stimulating children's interest in what is to them the great unknown. The great majority of teachers' requests for such maps, however, is not for such a purpose but for the purpose of helping to teach children how to "read" maps--in other words for pictorial maps to use as stepping stones towards the understanding of cartographic symbols. It is that idea which, in the writer's opinion, is fundamentally wrong. As has already been explained earlier on in this paper, the normal child experiences no special difficulty in accepting as a symbol for something an object or a mark which is in no sense a facsimile representation of that something. The block of wood is readily accepted as a symbol for the motor-bus, and the square drawn in pencil on the paper is accepted as representing the chicken house. Since no physiological or psychological difficulties stand in the way of the use of symbols from the outset why not use them? To use facsimile

representations first is only to prolong the process and more important, it invites the resentment of the child when the substitution of pictures by symbols is attempted. Naturally the child will prefer facsimile representations if these are offered because they are more readily identified and might be described as more amusing but, if they are never offered, the child will never miss them. Moreover the child's own progress with map making will be hindered if a start has been made with facsimile representations of hills, woods, houses and other features of the landscape because the rate of progress will depend to a large extent upon the child's ability to draw recognizable representations of these things. Some children are very slow to learn how to draw reasonably well and a reasonable accomplishment in that art may well be delayed much longer than the ability to draw a map, using symbols which call for no high degree of competence in drawing. For these reasons the writer urges that symbols should be used from the outset so that their use comes to be associated with maps in the child's mind from the very beginning of its education in the use and making of maps. Familiarity with the use of simple symbolical devices will make it easier in later stages for the child to comprehend more complicated devices (such as contours)and there will be no beginning all over again such as is inevitable when pictures and drawings are used to start with, nor will complications arise from lack of room when more detail has to be shown on a map made on a small scale. To these arguments the protagonists of pictorial representation may reply "These may be sound arguments where the representation of familiar objects is concerned but how can a child be brought to understand a symbol for something it has never seen?" To that question the writer makes answer "By showing the child the object or, if that cannot be done, by showing it a picture or photograph of that object--the picture or

photograph being in another book and not on the map on the wall or in the atlas." The point here is that it is not the business of the cartographer to show on maps what features or objects look like but to show where they are. Once anyone starts off on the wrong foot and begins to confuse the respective functions of the picture book and the map many future difficulties are invited.

Reverting now to problems connected with the round world and flat maps--it is said that, having taught a child that the world is round, it is extraordinarily difficult to convince the same child that portions of the curved surface of the world can be represented with reasonable accuracy on a flat surface like that of a piece of paper. Put like that one might be tempted to agree wholeheartedly but, in fact, it is the writer's belief that, though a degree of difficulty is admitted, that degree has been wildly exaggerated. The whole question turns on whether one is going to be satisfied with convincing the child that portions of the Earth's curved surface can be represented on a flat piece of paper or whether one is foolish enough not to be satisfied with achieving this but to insist on explaining how this is made possible. Going back to the analogy of the telephone--the important thing is to convince the child that it works--the scientific explanation of how the thing works can safely and properly be left for someone to tackle in the years ahead. The difficulty, then, which does have to be surmounted is the difficulty of convincing a child that portions of the curved surface of the Earth can be represented on flat paper and it is that difficulty which the writer believes to be generally overestimated.

Very small children live in a world which is absolutely full of unexplained phenomena. They are far more accustomed than adults to accepting what any grownup tells them as the truth--to taking apparently

inexplicable things for granted without worrying too much about how or why. Therein lies the importance of making it a fixed principle never to tell a child a lie. So long as no adult tells a child a lie, so long as the child's implicit faith in the truthfulness of the grownups is never rudely shattered nor even gradually undermined, the process of education can proceed smoothly because many things too difficult for the child to understand can be passed over for the time being--the teacher's assurance being accepted without question. To put the matter in a nutshell--very young children must be told the truth but, unlike magistrates and judges, they need not be told the whole truth nor is it necessary to prove to them in full detail the truth of what they have been told because, again unlike magistrates and judges, they will usually believe what they are told without demanding proof. Therein lies the added importance of never telling them untruths such as used commonly to be told children about Father Christmas coming down chimneys and about babies being brought by storks and hidden under gooseberry bushes. Once a child realizes that it has been told an untruth about something by an adult implicit faith is destroyed and the tendency to demand proof begins to develop. As a result progress in education is delayed and teaching becomes more and more difficult.

Most very young children, when told that the world on which they live is round, will believe the statement although it offends their senses which tell them that it looks more or less flat--that is to say, not curved. Since they will so readily accept this astonishing statement why should it be regarded as unlikely that they will accept the further statement that small portions of the curved surface of the Earth appear relatively flat and, as such, can be reasonably well represented on a flat piece of paper? Indeed few children will question that statement and it is not really

essential to try to offer them any sort of proof though it is always a good thing to do so if the opportunity arises, as it may do at the seaside or on a steamer trip at sea followed by a walk inland. Demonstrations of any kind are always useful and one often used by the writer may be described as an example of what can be done with the most simple apparatus. Take an old rubber ball and emphasize its roundness to a child. Roll it down the garden path--pick it up and hand it to the child, letting the child feel its curved surface. Suggest that the child should try to make it spread out flat on the table or on any hard, flat surface. The child will obediently try and will readily agree that this cannot be done. Now take a knife and cut a small portion of rubber out of the ball. Give it to the child and emphasize that that small portion cut from the round ball looks very nearly flat. Let the child press the portion of rubber against a hard flat surface and register the fact that it will go almost flat. Now explain in simple terms that, if a small portion of the Earth's surface were cut out in a similar way that portion would also look flat. Result:- the child accepts the idea that, although the surface of the world is curved in the same way as the surface of the rubber ball is curved, small portions of that surface (at least as much as one can see at a time) look nearly flat. No further argument is likely to arise. A simple demonstration has supported a firm statement of fact, the child's own senses have confirmed that it has been told the truth and progress has been made. The scientific explanation of how the detail on a curved surface can be projected on to a plane surface with the minimum of distortion can wait several years without hindrance to the child's progress towards understanding simple maps. Wherein lies this supposed enormous difficulty? Since readers may, however, justly observe that, though the writer may claim to have shown how a young child

may be helped over some of the difficulties of reconciling the globe (as representing the round world) with flat maps as representing smaller portions of the surface of the round world, the difficulty of reconciling the flat map of the whole world with the globe remains to be solved. This is indeed the case and the difficulty is most pronounced when the map of the whole world on Mercator's Projection is involved because the distortion of areas such as Greenland and South America is so very great and even the smallest children can observe this distortion for themselves when comparing the shape and size of either of these areas as shown on the globe with the shape and size of the same areas as shown on the Mercator map. Moreover the successful demonstration with the rubber ball can become an embarrassment because, having demonstrated that the whole world (as represented by the rubber ball) cannot be laid out flat but only small portions of it at a time, the child will be all the more mystified by the flat map of the whole world as this would seem to represent the achievement of something already proved to be impossible! To overcome this very real difficulty several courses may be taken according to the age of the children concerned and the level of understanding they have reached in regard to maps. With younger children, that is to say with those between five and eight years of age, it is as well to postpone the problem altogether if that be possible and to keep flat maps of the whole world out of sight for the time being--especially those on Mercator's or any similar projection. If, however, this cannot be done and the question does arise before the right time to deal with it has arrived, then it must be faced, because any attempt to brush the matter aside without any explanation may easily arouse suspicions. When faced with this problem in his own teaching days, the writer used to seize the opportunity to use the Mercator world map as further proof of the

truth he had demonstrated with the rubber ball--the truth that, whilst one could represent small areas of the earth's surface fairly accurately on a flat surface, one couldn't do the same with the whole world. The children would be told that a man called Mercator had tried to do it and they could see for themselves what had happened. Then the distortion of Greenland and South America would be pointed out and comparison would be made with the globe. Finally, with an eye to the future, a word would be put in about Mr. Mercator having succeeded in <u>one</u> respect about which the children would learn when they were older, and, at that point, the matter would be closed. In the writer's experience this method of dealing with the difficulty almost always succeeded. The explanation offered satisfied the children's curiosity, resolved any developing sense of puzzlement and confirmed what they had previously accepted. Moreover it made no difficulties for the future, told no untruths and demanded no more of their intelligence than was fair to ask.

The various cartographic devices for representing the relief of the land have always provided teachers with problems and it is probable that the recent rise in favour of what is called "Graphic Relief" is largely one more of the many manifestations of teachers' difficulties in teaching very young children how to understand contouring on maps. "Graphic Relief," by which is meant the achievement what appears to be of a three-dimensional representation of the varying heights of land, is really no more than the old device of hill-shading better executed by modern methods and, as such, it has it's uses not only in the primary school but all the way up to university level. Many people look upon it as something the use of which should be restricted to maps and atlases intended for young children but this is far from being the case. In point of fact the writer believes

that "Graphic Relief" should be used with caution in the primary school whereas it may be (and is) used extensively at grammar school sixth form and university levels. The danger of the exclusive or over-use of this method of representing relief in primary schools lies in the fact that it may (and often does) retard children's understanding of contouring, and contouring they must learn to understand if, at later stages of their education, they are to be able to 'read' and 'interpret' Ordnance Survey maps and take G.C.E. at "O" or any other level. Arguments already used in regard to 'picture-maps' and pictorial or facsimile representations of any kind on maps apply in this case and it is the writer's firm conviction that, if "Graphic Relief" is used in the primary school (and a case may be made out for that), it should, at least, not be used by teachers as a means of evading the difficulty of teaching young children how to understand the idea of contouring. That said, it may be profitable to examine in greater detail how best the idea of contouring may be conveyed to very young children.

There are some who contend that the idea of contouring is altogether too difficult for primary school children at any age and that the attempt to explain this idea and demonstrate the method should be deferred till the child has entered the secondary school and this is not altogether so unreasonable as it might appear because the understanding of contouring involves the understanding of some very complex ideas all of which have to be understood in relation to each other and to the matter as a whole. Naturally one would not talk to a primary school child about "Vertical Intervals" and "Horizontal Equivalents" but, if the child is to comprehend the basic idea of contouring as a means of representing relief (together with relative heights and angle of slope) the ideas to which these names are given must be conveyed and there is a minimum average age at which they

can be comprehended. What is that age? Opinions differ very much but the writer thinks that it would be safe to say that serious instruction in contouring cannot be given to children much under the age of nine and often not until over that age. Much fun may be had with heaps of mud or sand before the age of nine but, although a good time may be enjoyed by all in this way, it is almost certain that no clear idea of what contouring means or how it represents the relief of land will emerge. It is suggested, therefore, that nine years be accepted as the minimum age at which instruction in contouring may usefully be commenced. Up to that age (and often for some time afterwards) children should be allowed to invent symbols for high ground or hills and use these on the maps they make. So long as each child makes the attempt to indicate in some manner whereabouts hills are situated it does not really matter very much how this is done. The important thing is that the child should recognize the necessity to show on its maps where the levels of the ground begin to change. If no idea of how to do this occurs to the child, help should, of course, be given but, usually, this will not be necessary.

Assuming that one has a group of children whom one considers to be ripe for serious instruction in contouring there are various ways in which one can make a start but the writer believes that nothing gives such good results as team work which provides opportunities for direct activity. Care must, however, be observed personally to direct all the activities of the children so that they never lose sight of the purpose of those activities. If they are not constantly reminded why they are doing such and such a thing and what effect doing those things has had on the object in view, their sense of purpose will soon be lost and the project will degenerate into something very different from instruction in contouring. It is usually

better to work out of doors in fine weather but, if there is somewhere under cover where an artificial mountain may be made of mud or wet sand without breaking any regulations, instruction indoors is quite possible.

It would be inappropriate in a paper of this description to attempt to describe in the fullest detail how to give elementary instruction in contouring. It must be assumed that all teachers know more or less well how to go about the matter and it would be wrong to suggest that there exists one single method which is the best method and the one which every teacher should adopt. In truth the best method is the one which a teacher finds by experience to be the method which gives him or her the best results. All variations in the method of giving elementary instruction in contouring do, however, involve the provision of an artificial hill or mountain and there must be measuring and marking. Some teachers find it best to do all the practical work themselves with the children watching but inactive whilst others find that controlled activity, with the children doing most of the practical work under guidance, gives the best results and ensures that they remain interested in what is going on. Whatever variations of method are used and whether the children are active or inactive it is essential to observe a certain sequence and for the teacher to make sure that certain things are fully understood by the children before an advance is attempted. These are points of exceptional importance and may reasonably be dealt with at some length in a paper which is mainly concerned with the psychological aspects of instruction in this subject.

The most important thing of all to remember is that the children must be brought to understand at each stage of instruction why anything is being done in a certain way and what is the object of doing it. One must explain the object and intention of every step about to be taken and, when the action

has been taken, one must show by demonstration that the object has been attained. In many cases instruction, which was otherwise competent and would have been successful, has failed because the children were left uncertain why something had been done (or done in a certain way) and this bedevilled instruction at every stage beyond. Teachers are liable to go wrong in this way at every stage but more often the mistake is made at one or other of the earlier stages, instances of which follow. Sometimes it is taken for granted that the children understand that the base-board (or the ground or floor, as the case may be) on which the artificial mountain has been made represents sea-level and that sea-level is "Nought Level," or "nought feet," according to the unit of measurement adopted. Another frequent cause of difficulty is the failure to make quite sure that the children fully understand why, in order to find whereabouts on the mountain sides to mark a line showing a fixed height above sea-level, it won't do to measure a fixed number of inches over the sloping sides of the mountain. This is the point at which, in the simplest language, the teacher attempts to fix in the children's minds the essential difference between "Vertical Interval" and "Horizontal Equivalent" and, unless he succeeds in doing this, all future instruction will be largely without value. The explanation must be clear and plenty of time must be devoted to it. It must be amplified by demonstration and the children are best convinced by being allowed to prove the point for themselves by experiment. Likewise, when the points through which to draw the first contour line are fixed by experiment (usually by pressing the ruler into the mud or sand at different places until a correct reading of inches is obtained) it must be explained to the children that this is done in real life by a wonderful instrument about which they will learn later on, and not by boring down through the mountain. It might

be thought that the point is unimportant and therein lies the mistake. Children are realists and, although they will accept as true something which seems to them improbable or strange provided an explanation or an assurance is offered, they will puzzle over the same thing if it is not explained. So long, therefore, as the process of digging the ruler into the "mountain" to find the height at a certain place is explained as a makeshift which will give the result needed, all will be well. If the point is not made suspicions may be aroused which may develop into an attitude of unbelief towards the whole business. These instances may suffice to show the importance of explaining everything at every stage and of providing demonstrations to support the explanations.

In the later stages of teaching contouring it is usually thought a good thing to allow the children to build a relief map for themselves--providing them, of course, with as much practical help as may be necessary in the way of cutting out the layers of linoleum or plywood and fixing the same in their correct places. This is, indeed, an excellent aid to full understanding once the basic ideas have been conveyed. Too often, however, it is attempted at too early a stage and then much of the value of the exercise or project is lost. For this reason it is a good thing to devote one or two classroom lessons to the making of such a relief map before letting the children go ahead with making one themselves. Some teachers seem to think that it is barely possible to give a lesson in class in this way but the writer has not only successfully done so in a classroom but also by television broadcasts and is therefore convinced that it is something which teachers can attempt with every hope of success. The value of the class demonstration lies chiefly in the fact that, during the building-up of a relief map before the children's eyes, all previous explanations and

demonstrations are, or can be, repeated and opportunities arise for testing the children's understanding and remembrance of points specially stressed in earlier lessons. The vastly important sequence of operations can again be emphasized in the best way possible--that is by actually carrying out each operation in turn and in the correct order--and the relationship between the visible layer contours of the model and the contoured map from which they were copied can be effectively demonstrated.

Reference to the making of relief model maps leads one to the consideration of the making of maps generally--the making of them by children from early ages up to and beyond adolescence. This, say some people, is a time-consuming business and, whereas a few children may teach themselves something by such means, many will fritter away hours scrawling and daubing unintelligently on pieces of paper without learning anything to speak of. With that point of view the writer has no sympathy nor has he much respect for those who advance it. The secret of teaching very young children how to begin to understand maps lies in securing their interest in maps and there exists no better way by which to secure the interest of a child than to set it to create something. That is not to say that children should not have printed maps and atlases of a kind appropriate to their age, for such are essential, but they should also be encouraged to make plans and maps of all kinds--plans of the playground or the garden, maps of the village, maps of the common and, in fact, maps of any area so long as nothing over-complicated is attempted. In this way classroom explanations of cartographic symbols and of scale will be supplemented by practical experiment and the whole business will be invested with an interest not otherwise to be engendered. Let no one worry if children's early efforts are crude and inaccurate--so long as interest is aroused, stimulated, maintained and intelligently directed, the

foundations will be firmly laid of a full understanding of maps and of the special purposes for which men invented them.

Finally let there be no evading of issues and no attempt made to excuse such evasion on the grounds of alleged special difficulties. Difficulties there are but they are largely the same difficulties which teachers have to face when attempting to teach very young children anything and, in the writer's opinion, it is doubtful whether it is any more difficult to teach children how to understand a simple map than it is to teach them how to read or write.